

## Influence of intercropping systems and weed management practices on the growth and yield of irrigated cotton

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**Abstract:** Field experiments were conducted at Agricultural College and Research Institute, Killikulam to find out the suitable intercrop and weed management practices on cotton under irrigated condition. The results revealed that higher growth and yield attributes and yield were recorded in sole cotton than cotton intercropped with either cowpea or soybean. Pre-emergence application of metolachlor at 1.00 kg ha<sup>-1</sup> through herbigation with one hand weeding on 40 DAS significantly enhanced the growth, yield attributes and yield of cotton. The interaction between intercropping and weed management practices indicated that cotton and soybean intercropping system applied with the metolachlor herbicide as pre-emergence at 1.00 kg ha<sup>-1</sup> through herbigation with one weeding on 40 DAS registered higher growth, yield attributes and yield. (*Key words* : Cotton, Intercropping, Cowpea, Soybean, Weed Management, Herbigation)

Cotton being a slow growing in early stages and wide spaced crop, facilitates intense growth of weeds. Because of higher competitive nature of weeds for natural resources, productivity of cotton is affected (21-61%) (Sankaran *et al.* 1993) since it is a wide spaced and long duration crop, it provides ample scope for raising intercrops to have effective resource utilization with yield advantage and enhanced income from unit area of land.

Traditionally, is intercropped with short duration pulses, onion and other oilseed crops for getting a sustainable additional income (Patel *et al.* 1995). Intercrops provide efficient coverage of land resulting in suppressed weed growth. But intercropping alone is not sufficient to have effective weed control due to varied canopy coverage by different intercrops. Manual weeding is not always practicable. Availability of agricultural labourers for timely weeding may be inadequate owing to peak season labour demand. Further manual weeding is too expensive. Therefore chemical weed control provides an alternate solution in times of labour scarcity. Integrated weed management is gaining momentum due to its effectiveness in controlling weeds and being friendly to environment. For effective weed control, uniform application of herbicide is very important. Among the herbicide application techniques, herbigation is simple, economic and more reliable one (Iruthayaraj, 1991). With a view to develop

most efficient, eco-friendly and economically viable integrated weed management practices for cotton based cropping system by combining mechanical and chemical methods, the present study was undertaken.

### Materials and Methods

Field experiments were conducted in cotton during winter seasons (September-February) of 1992-93 and 1994-95 at Agricultural College and Research Institute, Killikulam (Lat.8°46'N, Long.77°42'E and altitude 40M). The soil of the experimental field was red sandy loam (Typic rhodostaulf) with a pH of 6.6-7.5, medium in available nitrogen (278 kg ha<sup>-1</sup>), high in available phosphours (26 kg ha<sup>-1</sup>) and high in available potassium (491 kg ha<sup>-1</sup>). The trial was laid out in split-plot design with three replications. The main plot consisted of three cropping systems, viz. C<sub>1</sub> cotton sole crop, C<sub>2</sub> cotton + cowpea at 2:2 ratio and C<sub>3</sub> cotton+soybean at 2:2 ratio. The sub-plot consists of ten weed management practices viz.

- W<sub>1</sub> Metolachlor at 0.75 kg ha<sup>-1</sup> as herbigation
- W<sub>2</sub> Metolachlor at 1.00 kg ha<sup>-1</sup> as herbigation
- W<sub>3</sub> Metolachlor at 0.75 kg ha<sup>-1</sup> as spray
- W<sub>4</sub> Metolachlor at 1.00 kg ha<sup>-1</sup> as spray
- W<sub>5</sub> Pendimethalin at 0.75 kg ha<sup>-1</sup> as herbigation
- W<sub>6</sub> Pendimethalin at 1.00 kg ha<sup>-1</sup> as herbigation
- W<sub>7</sub> Pendimethalin at 0.75 kg ha<sup>-1</sup> as spray
- W<sub>8</sub> Pendimethalin at 1.00 kg ha<sup>-1</sup> as spray

Table 1. Influence of intercropping systems and weed management practices on the growth attributes of irrigated cotton

Treatments	Plant height at harvest (cm)		Leaf area (cm <sup>2</sup> ) at 90 DAS		CGR at 90 DAS-harvest (gm <sup>2</sup> day <sup>-1</sup> )	
	1992-93	1994-95	1992-93	1994-95	1992-93	1994-95
<b>Cropping systems</b>						
C <sub>1</sub> Cotton sole	89.33	84.98	3959	3781	4.32	4.11
C <sub>2</sub> Cotton+cowpea	84.28	81.09	3585	3411	3.88	3.70
C <sub>3</sub> Cotton+soybean	87.88	83.51	3764	3458	4.04	3.58
CD (P=0.05)	1.86	1.00	61	88	0.08	0.14
<b>Weed management practices</b>						
W <sub>1</sub> Met. 0.75 (Herb.)	96.69	93.85	4244	3976	4.49	4.16
W <sub>2</sub> Met. 1.00 (Herb.)	102.05	97.80	4483	4255	4.73	4.41
W <sub>3</sub> Met. 0.75 (Spray)	93.46	90.49	3810	3538	4.33	4.07
W <sub>4</sub> Met. 1.00 (Spray)	98.71	94.39	4334	4095	4.59	4.30
W <sub>5</sub> Pen. 0.75 (Herb.)	86.53	82.61	3665	3428	3.92	3.64
W <sub>6</sub> Pen. 1.00 (Herb.)	91.26	87.01	3907	3658	4.17	3.89
W <sub>7</sub> Pen. 0.75 (Spray)	84.25	79.70	3553	3349	3.79	3.60
W <sub>8</sub> Pen.1.00 (Spray)	88.31	83.32	3749	3529	4.01	3.85
W <sub>9</sub> H.W. twice	83.24	80.06	3503	3285	3.78	3.50
W <sub>10</sub> Unweeded check	47.13	42.7	2438	2094	3.00	2.55
CD (P=0.05)	1.93	1.44	102	88	0.12	0.16

W<sub>9</sub> Hand hoeing and weeding at 20 and 40 DAS

W<sub>10</sub> Unweeded check

One hoeing and weeding was given to all the herbicide treatments (W<sub>1</sub> to W<sub>8</sub>) at 40 days after sowing.

Delinted cotton seeds (MCU11) were sown in paired rows (90x30 cm - 60x30 cm). In case of sole crop, cotton seeds were sown in normal rows at a spacing of 75x30 cm. Three seeds were dibbled hill<sup>-1</sup>. The intercrops viz. cowpea (Co 4) or soybean (Co 1) was sown in two rows in between pairs of cotton rows by adopting a spacing of 30 cm between rows and 10 cm between plants within the row. The recommended dose of 80:40:40 kg NPK ha<sup>-1</sup> was applied to cotton crop. Basal dose of 40:40:40 kg NPK ha<sup>-1</sup> was applied at sowing and 40 kg N ha<sup>-1</sup> was top dressed at the time of square initiation. For herbigation, saline drip bottle (500 ml) was taken and filled with herbicides without any dilution. This was hanged downward at a

height of 5' in front of irrigation channel in order to drip the herbicide droplets continuously on top of the flowing irrigation water through gravitational pressure. The quantity of herbicides required per unit area was calibrated considering the quantum of water flow. Herbicides were applied along with life irrigation (3 days after sowing). For spraying calculated quantities of herbicides were mixed with water at the rate of 750 t ha<sup>-1</sup> and applied uniformly on the soil surface using a hand operated backpack sprayer.

The observation on plant height and leaf area were recorded at 90 DAS, maturity and also CGR (Crop growth rate) at 90 DAS harvest was recorded on cotton. The yield and yield parameters of cotton and intercrops were recorded at harvest. Yield of intercrops was also recorded.

## Results and Discussion

### *Effect of intercropping system on cotton*

The results revealed that the growth and yield of cotton were affected due to the intercropping

Table 2. Influence of intercropping systems and weed management practices on the yield attributes, yield and BC ratio of irrigated cotton

Treatments	Boll number plant <sup>-1</sup>		Boll weight (g)		Cotton kapas yield (kg ha <sup>-1</sup> )		Cowpea yield (kg ha <sup>-1</sup> )		Soybean yield (kg ha <sup>-1</sup> )		B:C ratio	
	1992-93	1994-95	1992-93	1994-95	1992-93	1994-95	1992-93	1994-95	1992-93	1994-95	1992-93	1994-95
<b>Cropping systems</b>												
C <sub>1</sub> -Cotton sole	13.32	12.69	4.50	4.41	1935	1789	-	-	-	-	2.89	2.67
C <sub>2</sub> -Cotton+cowpea	12.32	11.55	4.35	4.23	1815	1659	-	-	-	-	3.07	2.73
C <sub>3</sub> -Cotton+soybean	13.13	12.43	4.47	4.36	1899	1746	-	-	-	-	3.20	2.91
CD (P=0.05)	0.11	0.08	0.03	0.03	19	25	-	-	-	-	-	-
<b>Weed management practices</b>												
W <sub>1</sub> -Met. 0.75 (Herb.)	14.53	13.84	4.60	4.39	2159	2006	286	240	434	389	3.59	3.27
W <sub>2</sub> -Met. 1.00 (Herb.)	15.96	14.43	4.75	4.53	2287	2111	312	271	467	410	3.79	3.41
W <sub>3</sub> -Met. 0.75 (Spray)	13.91	13.41	4.55	4.35	2078	1912	263	219	411	366	3.41	3.15
W <sub>4</sub> -Met. 1.00 (Spray)	14.61	13.92	4.65	4.45	2197	2033	291	247	446	390	3.57	3.26
W <sub>5</sub> -Pen. 0.75 (Herb.)	12.65	12.10	4.36	4.19	1865	1719	223	169	373	322	3.00	2.72
W <sub>6</sub> -Pen. 1.00 (Herb.)	13.28	12.53	4.48	4.28	1989	1826	244	196	397	350	3.14	2.85
W <sub>7</sub> -Pen. 0.75 (Spray)	12.00	11.47	4.29	4.07	1800	1660	205	142	357	311	2.88	2.60
W <sub>8</sub> -Pen.1.00 (Spray)	12.69	12.21	4.42	4.24	1907	1758	225	175	385	336	2.96	2.72
W <sub>9</sub> -H.W. twice	11.78	11.46	4.23	4.01	1784	1641	200	133	350	310	2.93	2.62
W <sub>10</sub> -Unweeded check	7.86	6.92	4.06	3.83	761	652	83	40	107	96	1.32	1.10
CD (P=0.05)	0.24	0.12	0.06	0.06	64	54	15	10	21	17	-	-

of cowpea and soybean. The plant height of cotton at maturity was lowered by 3.60 and 2.42 cm due to intercropping with cowpea and soybean (Table 1). The leaf area at 90 DAS was reduced at higher level in cotton + cowpea than cotton + soybean intercropping system. The crop growth rate (CGR) recorded at reproductive stage (90 DAS harvest) was higher with sole cotton and was lowered due to intercropping with cowpea and soybean. Intercropping also affected the various yield parameters viz. boll number and boll weight compared to sole cropping (Table 2).

The cotton kapas yield was reduced due to intercropping with cowpea and was higher (6.2 - 7.3%) than with soybean (1.9 - 2.4%). This was attributed to the competitive nature of the intercrops for light, nutrients and moisture (Palaniappan and Sivaraman, 1994). Among the two intercrops compared in this study, the adverse effect on the growth and yield of intercropped cotton was higher with cowpea than with soybean and this might be due to the spreading habit and higher leaf area of cowpea as against the erect growth and lesser leaf area of soybean. In spite of the yield reduction with intercropping of soybean and cowpea the BC ratio was higher in intercropping system viz., cotton + cowpea and cotton + soybean than sole cotton system

*Effect of weed management practices on cotton*

Adoption of different weed management practices significantly increased the growth attributes (plant height, leaf area and CGR) and yield attributes (boll number and boll weight) leading to higher kapas yield. Among the different weed

management practices adopted application of metolachlor at 100 kg ha<sup>-1</sup> as herbigation with one hand hoeing on 40 DAS significantly enhanced the growth and yield parameters compared to other weed management practices. All the weed management practices including hand weeding twice significantly improved the kapas yield from 1023-1526 kg ha<sup>-1</sup> during 1992-93 and 989-1459 kg ha<sup>-1</sup> during 1994-95 (Table 2). Whereas the unweeded check registered the lowest yield of 761 kg ha<sup>-1</sup> during 1992-93 and 652 kg ha<sup>-1</sup> during 1994-95. Pre-emergence application of metolachlor at 1.00 kg ha<sup>-1</sup> through herbigation and one hand weeding on 40 DAS resulted in the highest kapas yield of 2287 kg ha<sup>-1</sup> during 1992-93 and 2111 kg ha<sup>-1</sup> during 1994-95. The increased yield under different weed management practices was due to the effective control of weeds which might have eliminated the competition for light, nutrient and moisture by weeds. The critical stage of crop-weed competition in cotton has been identified as 4-6 weeks after sowing (AICRPWC, 1993). Hence cotton crop requires weed free condition during this period (Deshpande, *et al.* 1987). Effective control of weeds at this critical period by metolachlor at 100 kg ha<sup>-1</sup> as herbigation provided a weed free environment for better growth of cotton. This has reflected in the higher values of growth characters and yield attributes of cotton.

Yield of intercrops *viz.* cowpea and soybean was also higher with the metolachlor applied at 1.00 kg ha<sup>-1</sup> as pre-emergence through herbigation followed by one hand weeding on 40 DAS. This might be due to the effective control of weeds by metolachlor which enabled the intercropped cowpea and soybean to take up more nutrients

and exhibit better growth and yield (Dadari, *et al.* 1994 and Vedprakash, *et al.* 1991). Application of metolachlor at 1.00 kg ha<sup>-1</sup> as pre-emergence through herbigation with one weeding on 40 DAS registered higher BC ratio of 3.79 and 3.27 during 1992-93 and 1994-95 respectively.

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